

Event Display News

Dmitry Litvintsev

March 30, 2000

DAQ meeting



March 30, 2000

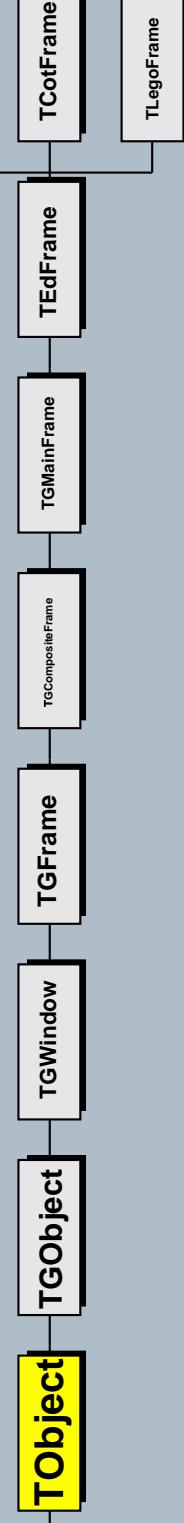
ED News

- Major reorganization of the package. Now it is much easier to maintain.
- Improved ROOT 3D graphics in the *Canvas*. Implemented primitive hidden line removal algorithm
- Several new views
- ED displays *Jets* in the LEGO plot
- ED homepage
<http://www-cdf.fnal.gov/upgrades/computing/projects/display/EventDisplay.html>
updated on the daily basis.
- Improved *on-line* and *off-line* help.
- ED now runs as simple as **evd 'filename'**
- A lot of debugging



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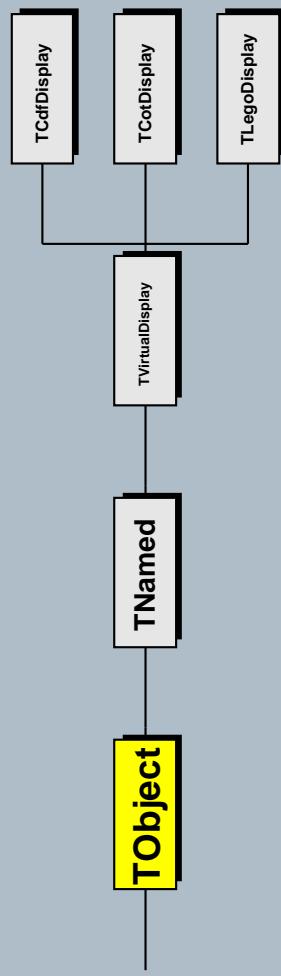
*TEdFrame





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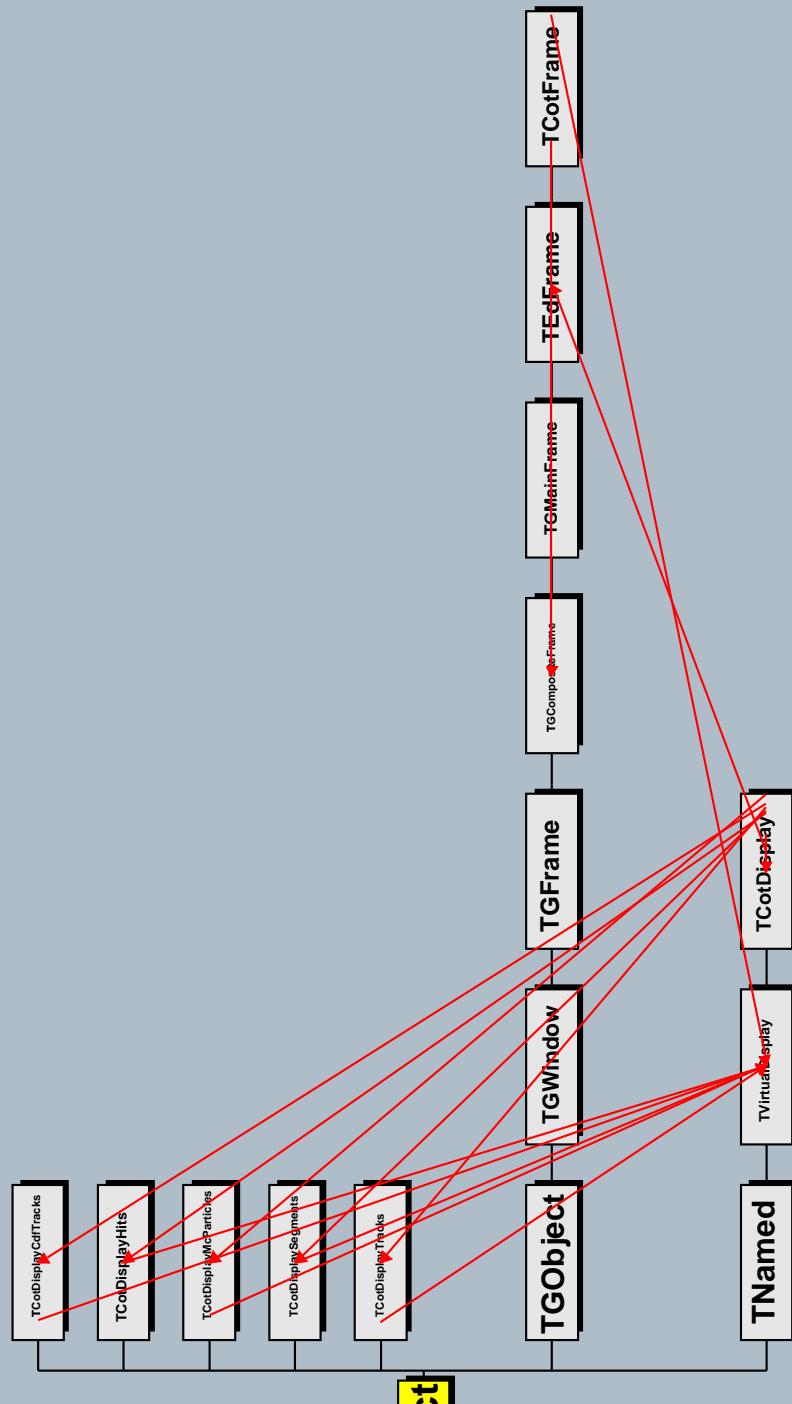
*TVirtualDisplay





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T^{Cot}*





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TCotDisplay

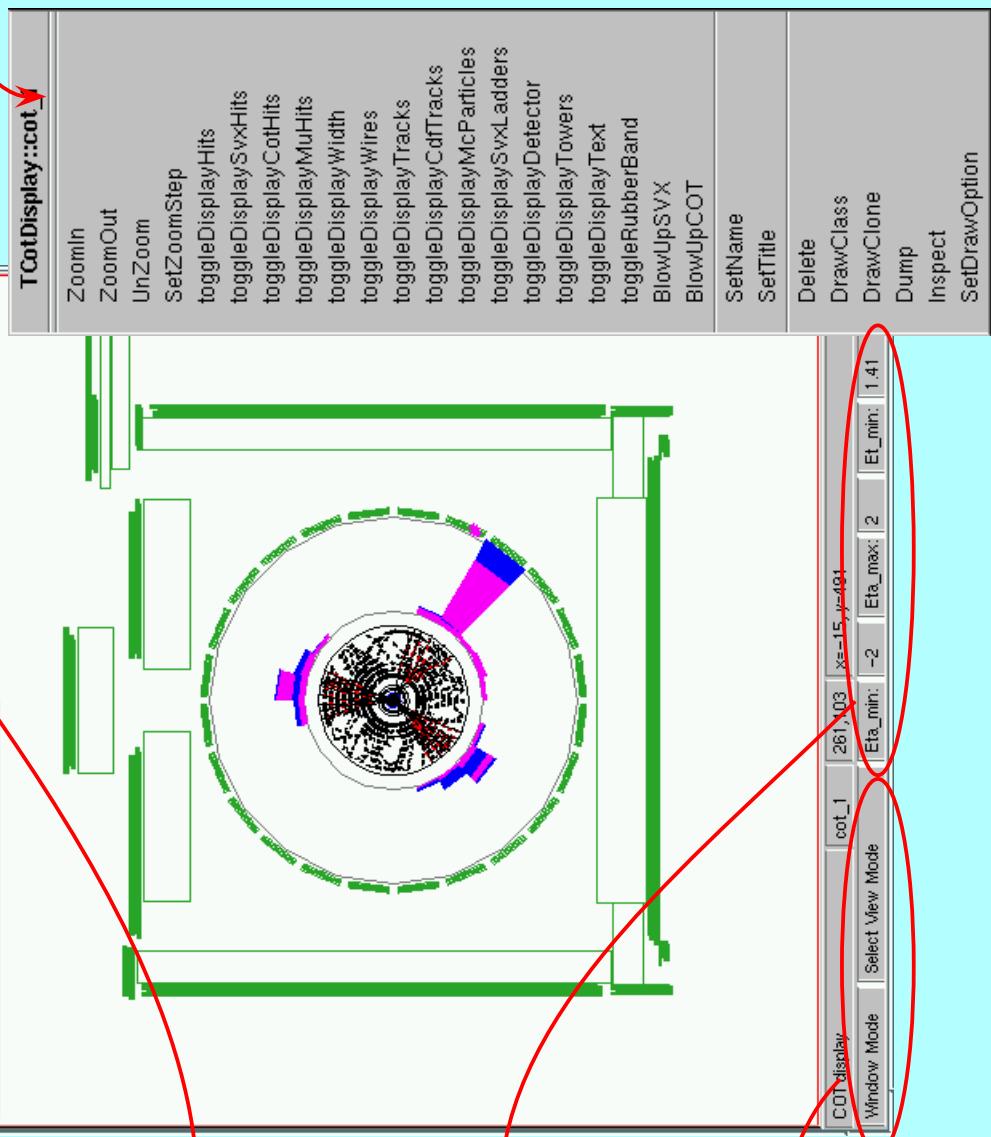
Root native Menu Bar

COT Menu Bar

COT display

File Edit View Options Inspect Classes
Event Options Select Cuts Histograms
Next event Previous event View Hit Segment Track MC Particle

Event : 1 Run : 1 EventType : 1



Select Mode Buttons

Current values of cuts

Window Status



ED window has the following elements:

ROOT native Menu Bar allowing usual ROOT functionality. Build by the **TEdFrame**. This menu bar is common for all ED windows (**COT, LEGO, CDF ...**)

Menu Bar specific to particular display. Build by either **TCotFrame, TLegoFrame, TCdfFrame**.

Buttons **Next Event**, **Previous Event**. **Select Mode** switch **buttons** – switch between **View mode**, where user has access to **Context Menu** of the particular Display with the right mouse button click, or manipulate with view – zooming using left mouse button, and special **Select Modes** which allow user to get access to the desired objects in the view and invoke context menus of these objects

Graphics Window common for all displays **TEdEmbeddedCanvas**

Status Bars :

- ✓ Standard for all windows, showing class name, class title, location of the cursor in pixels and in global coordinates. Depending on the **select mode** shows various information
- ✓ Window status bar showing its current select mode. Also shows η_{min} , η_{max} and $E_{T min}$ – values of cuts set from menu bar, pou pup meny item 'cuts'



Each action provided by ED can be performed in the variety of ways:

- ✓ Using Context Menu
- ✓ Using Pop Up menu of theMenuBar
- ✓ Using keyboard buttons – when the window is in *focus*. E.g. Zooming, Translation can be performed by pushing **Z/z**, **+/-**, **↑, ↓, →, ←**. Close current canvas - **C**, quit ED - **Q**.
- ✓ Explicitly typing necessary command, i.e. calling necessary member function from the command prompt: `gDisplay->ZoomIn()`.



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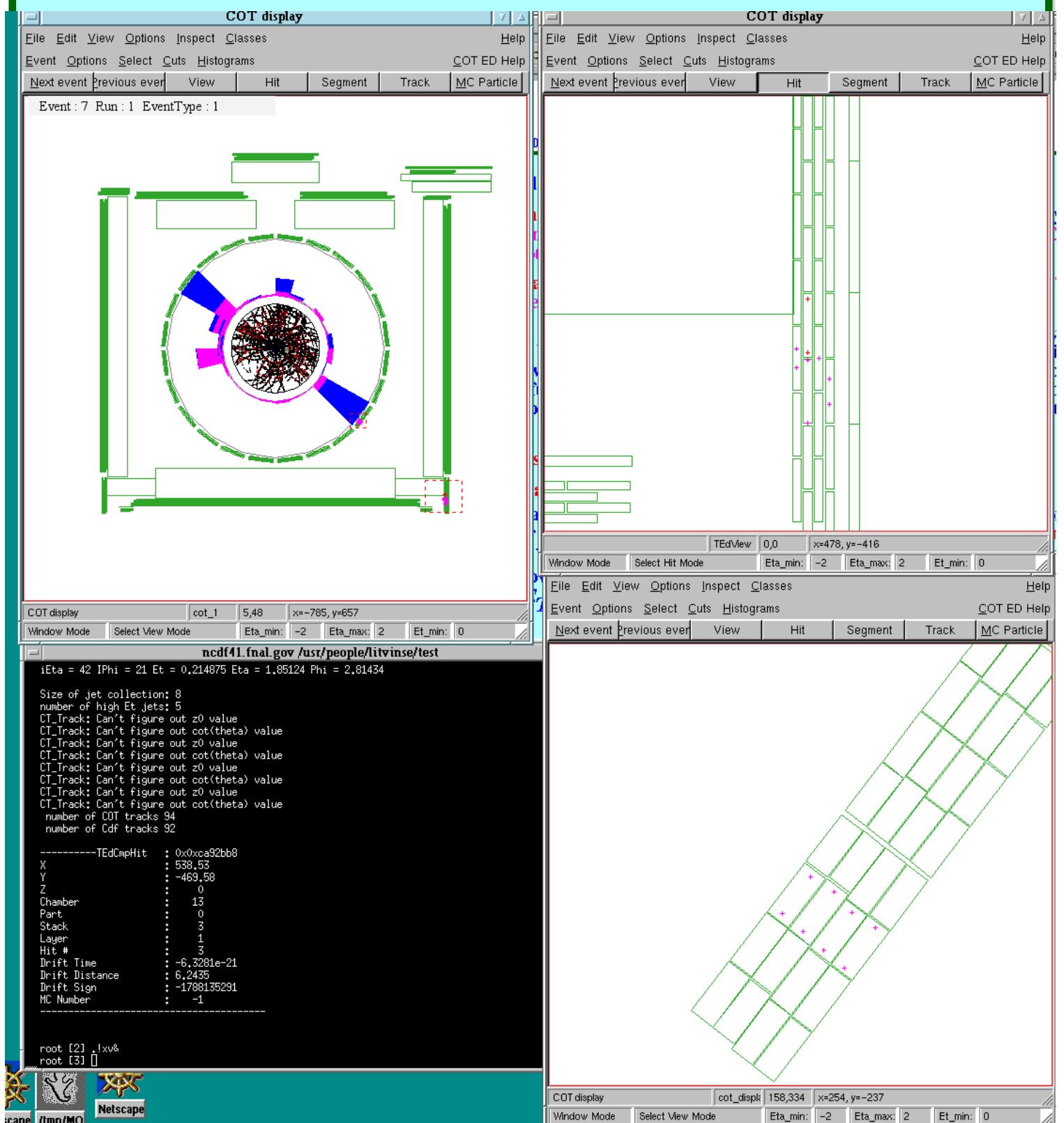
Misc. properties

- ✓ Windows are synchronized. Change of visual properties of graphics objects in one window propagate into the others. Same is true for cuts imposed from ED. This feature can be switched off.
- ✓ If resized windows preserve their original *aspect ratio* – this prevents circles from turning into ovals. This feature can be switched off.
- ✓ ZoomStep, MoveStep can be modified.
- ✓ Help is available *on-line*:
 - ☞ from command prompt `help()`
 - ☞ from **Menu Bar PopUp** menu 'Help'.
- ✓ Help is available *off-line* from Event Display Home Page
<http://www-cdf.fnal.gov/upgrades/computing/projects/display/EventDisplay.html>
- ✓ **Source code is available from**
<http://purdue-cdf.fnal.gov/CdfCode/source/RootEventDisplay/> and
<http://purdue-cdf.fnal.gov/CdfCode/source/RootMods/>



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RubberBand



ROOT 3D Graphics



Device Driver	wireframe	hidden lines	hidden surface	8 bit	16 bit	24 bit
G3D	✓	✗	✗	✓	✓	✓
X3D	✓	✓	✓	✓	✓	✓
OpenGL	✓	✓	✓	✓	✓	✓

- ☞ Note that OpenGL does not work properly over network on 8 bit Displays
- ☞ OpenGL support is not default. User needs to recompile ROOT source provided Mesa libraries are available on the system.
- ☞ Fermilab's ROOT distribution also lacks OpenGL support
- ☞ There are no 3D fonts in both X3D and OpenGL

Investing substantial efforts into development of OpenGL display is premature
Hence try to improve ROOT 'G3D' which is actually 2D X11 based graphics
(later about it in the talk)

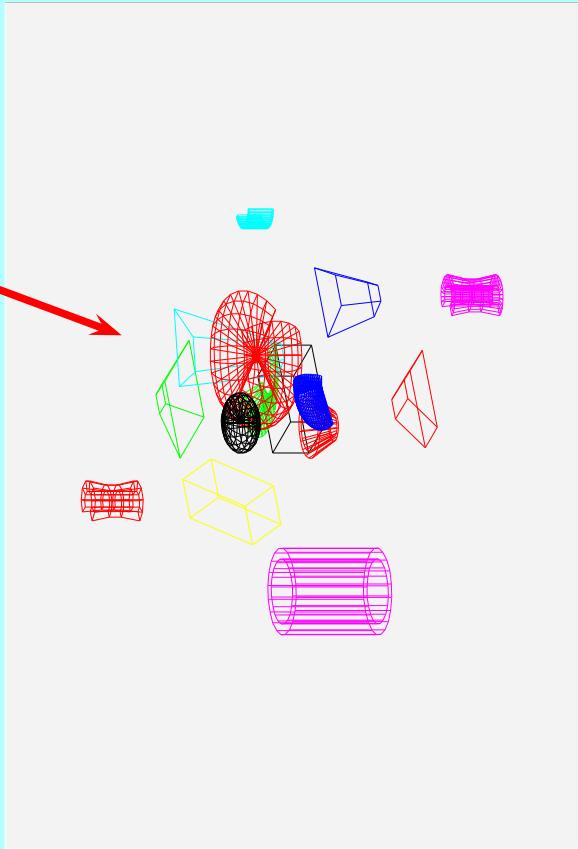
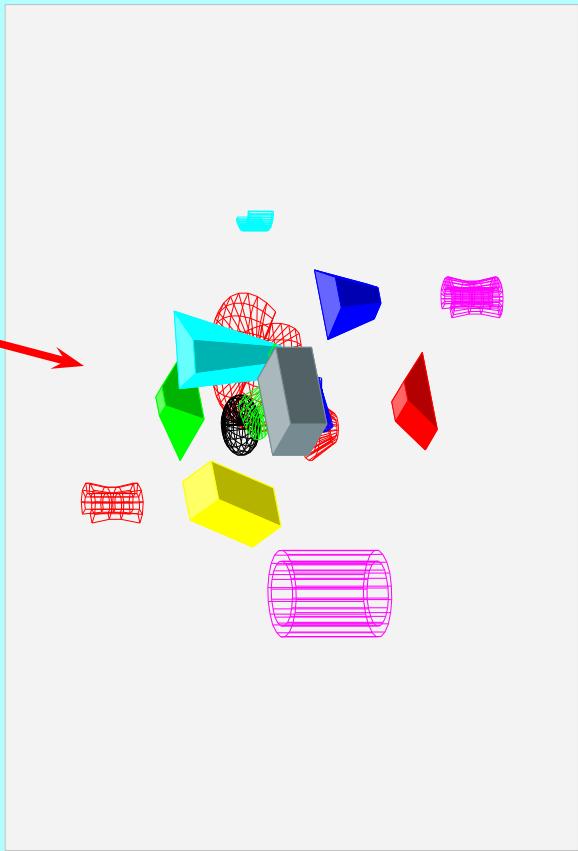


Improving ROOT graphics

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✗ ROOT has no option of solid surface drawing of 3D primitives in canvas. This is a disadvantage since **wireframed** representations of complex geometries are extremely hard to comprehend.

☞ Primitive *hidden line removal algorithm* has been developed within RootEventDisplay package. Now it allows to draw all available ROOT shapes which inherit from TBRIK. Primarily intended for LEGO $\eta - \phi$ calorimeter plot. Work on other shapes is underway.

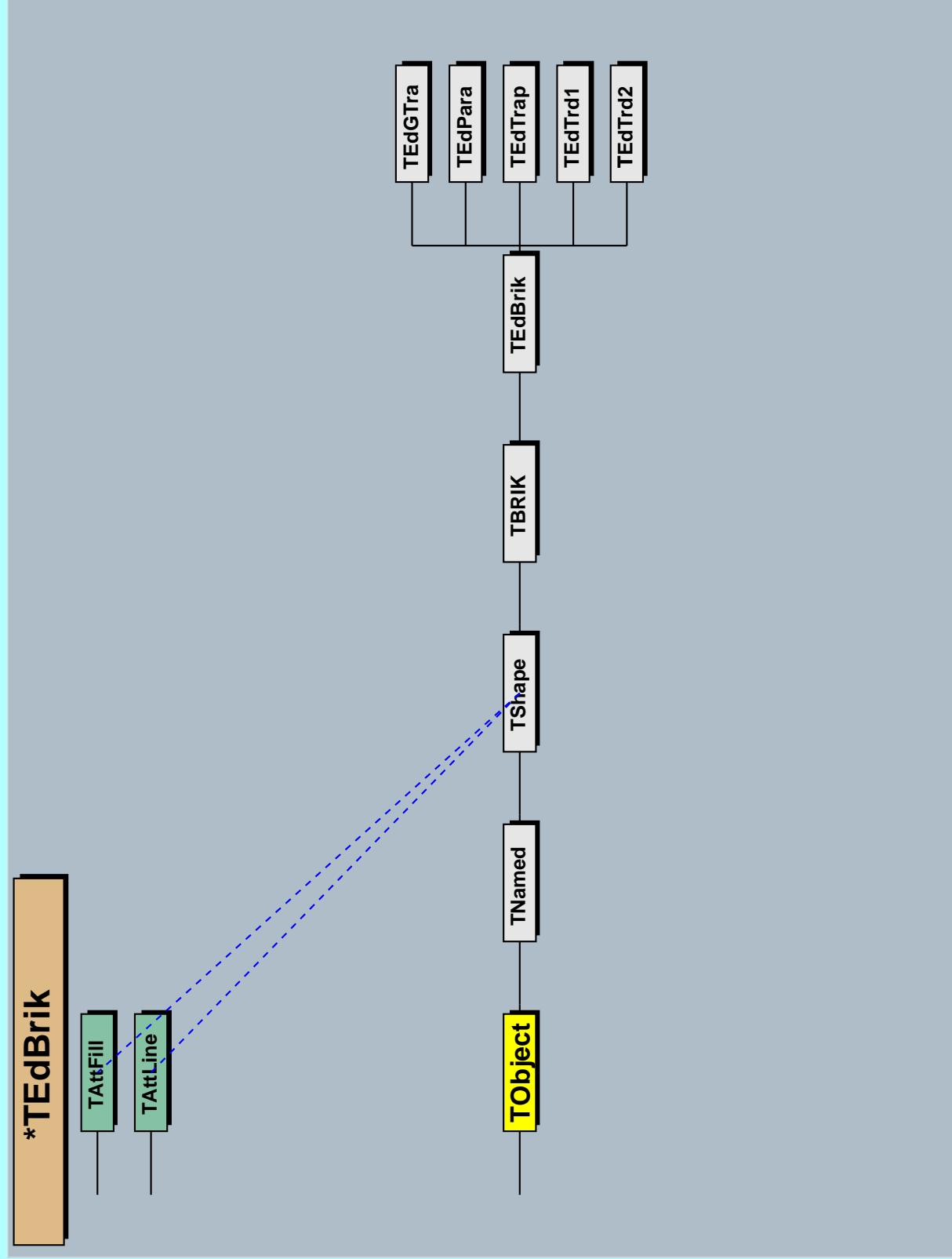


```
root[0] .x shapes.C
```

```
root[0] .L libEventDisplay.so  
root[1] .x evd_shapes.C
```



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Example of AppUserBuild module implementation

```
AppUserBuild::AppUserBuild( AppFramework* theFramework) : AppBuild(theFramework) {
    AppModule* aModule;
    APPInputModule* anInputModule;

    anInputModule = new APPInputModule( "FileInput", "Default Input Module" );
    add( anInputModule );

    aModule = new GeometryManager();
    add( aModule );

    aModule = new F77InterfaceModule("F77_MODULE","Default Fortran Interface");
    add(aModule);

    aModule = new INIT_MODULE( "INIT", "INIT" );
    add( aModule );

    aModule = new CalorimetryModule( "CalorimetryModule",
        "Calorimetry Module: D to CalData" );
    add( aModule );

    aModule = new JetClu("JETCLU", "Jet Clustering Routine");
    add(aModule);

    aModule = new CT_SimulationModule("CT_SimulationModule","Load MC info");
    add(aModule);

    aModule = new CT_TrackingModule("CT_Tracking","COT tracking");
    add( aModule );

    aModule = new TEventDisplayModule();
    add( aModule );
}

//-----
// Destructor --
//-----

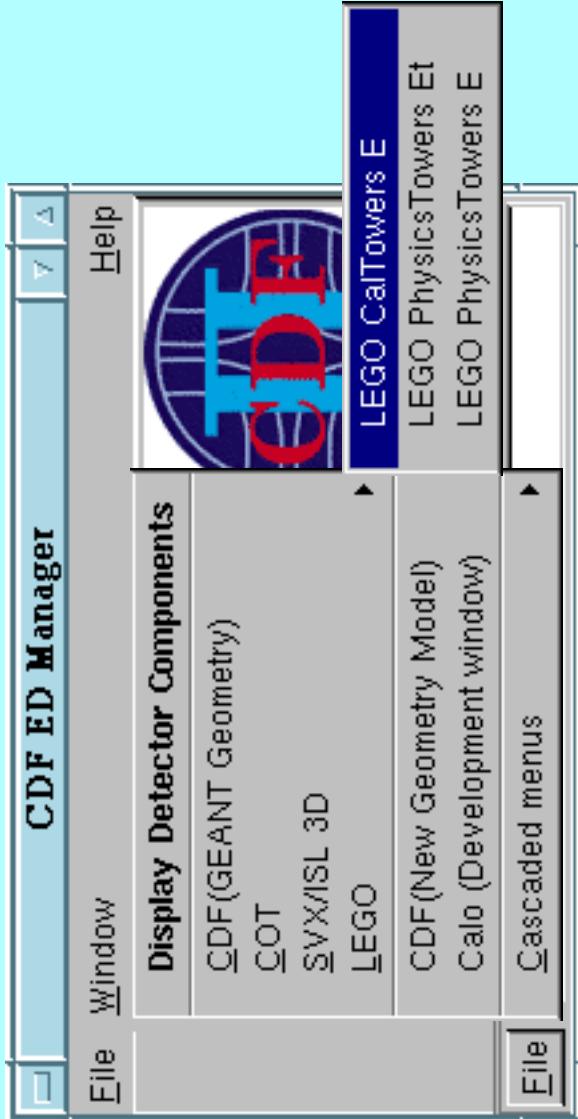

AppUserBuild::~AppUserBuild( ){}

const char * AppUserBuild::rcsId( ) const
{
    return rcsid;
}
```



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TEdManager



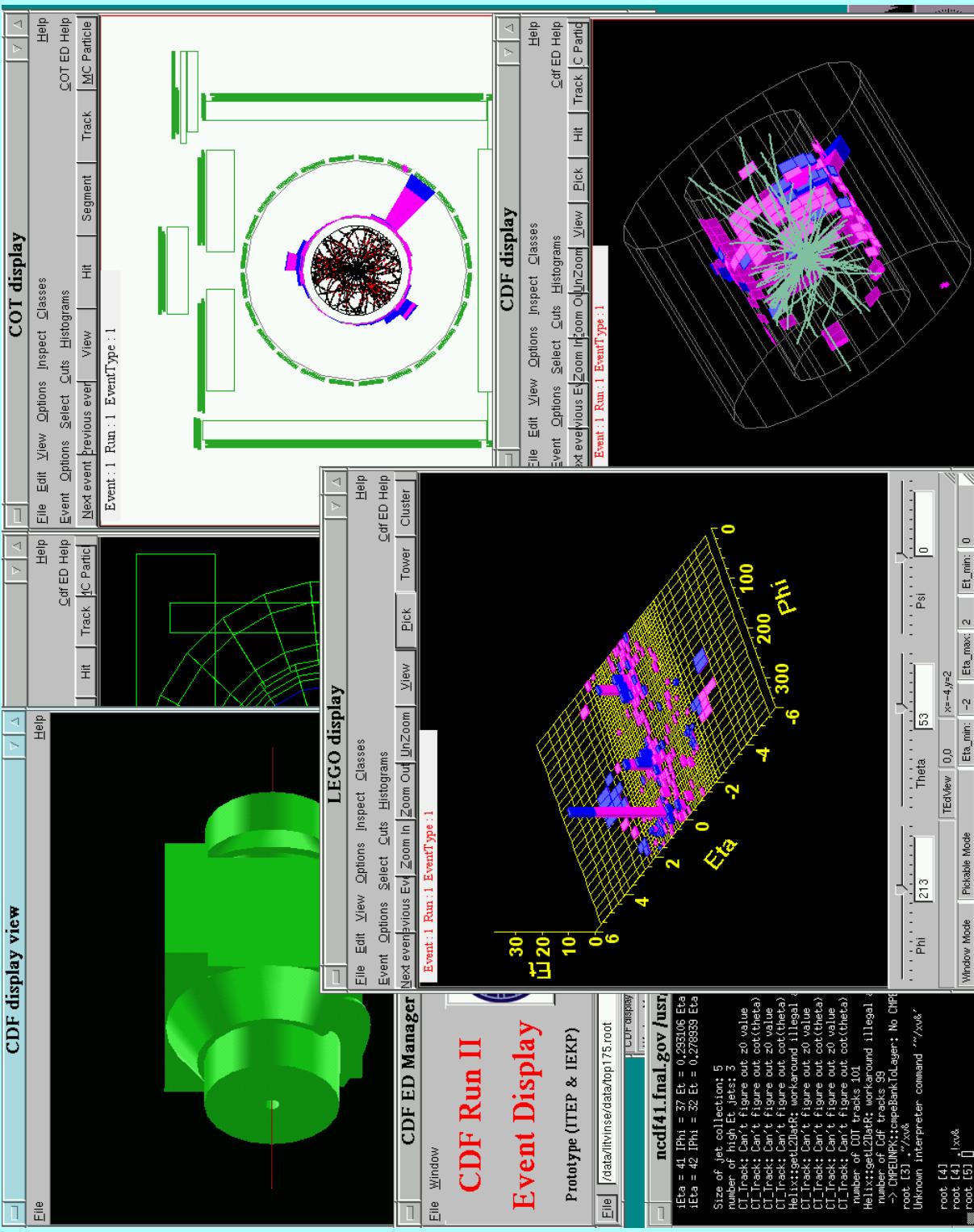
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CDF Run II Event Display

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Example Session



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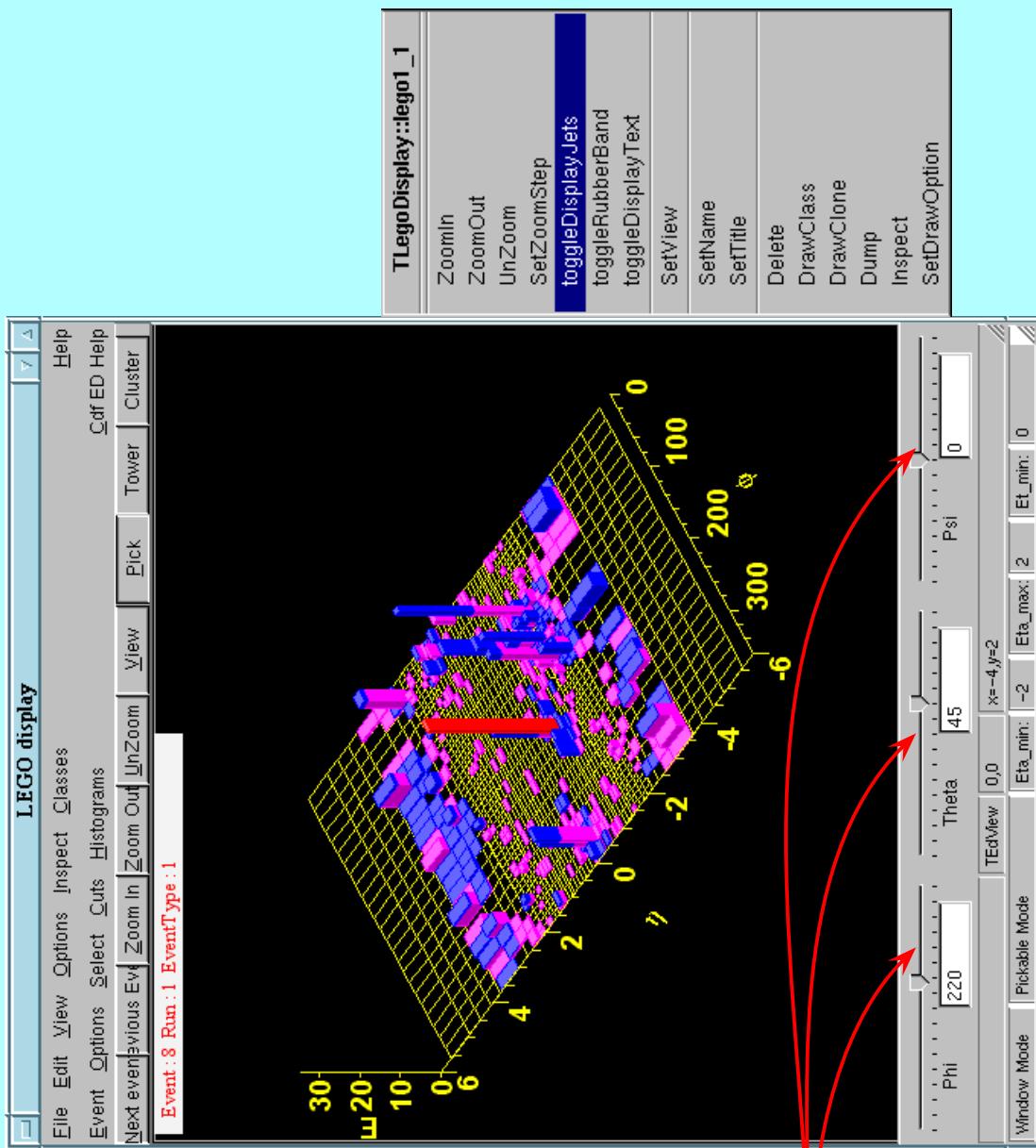
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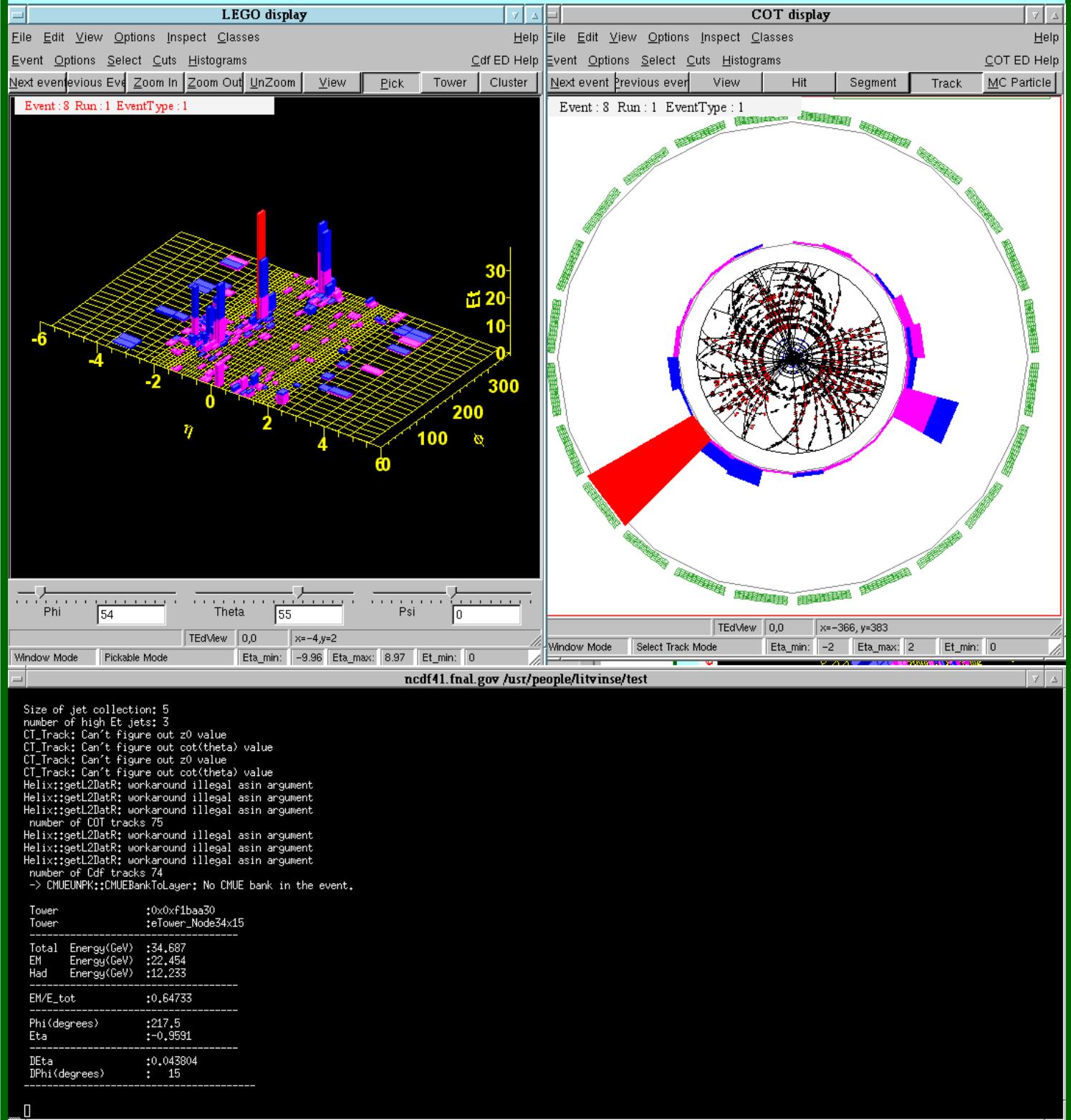
TLegodisplay



Rotation sliders

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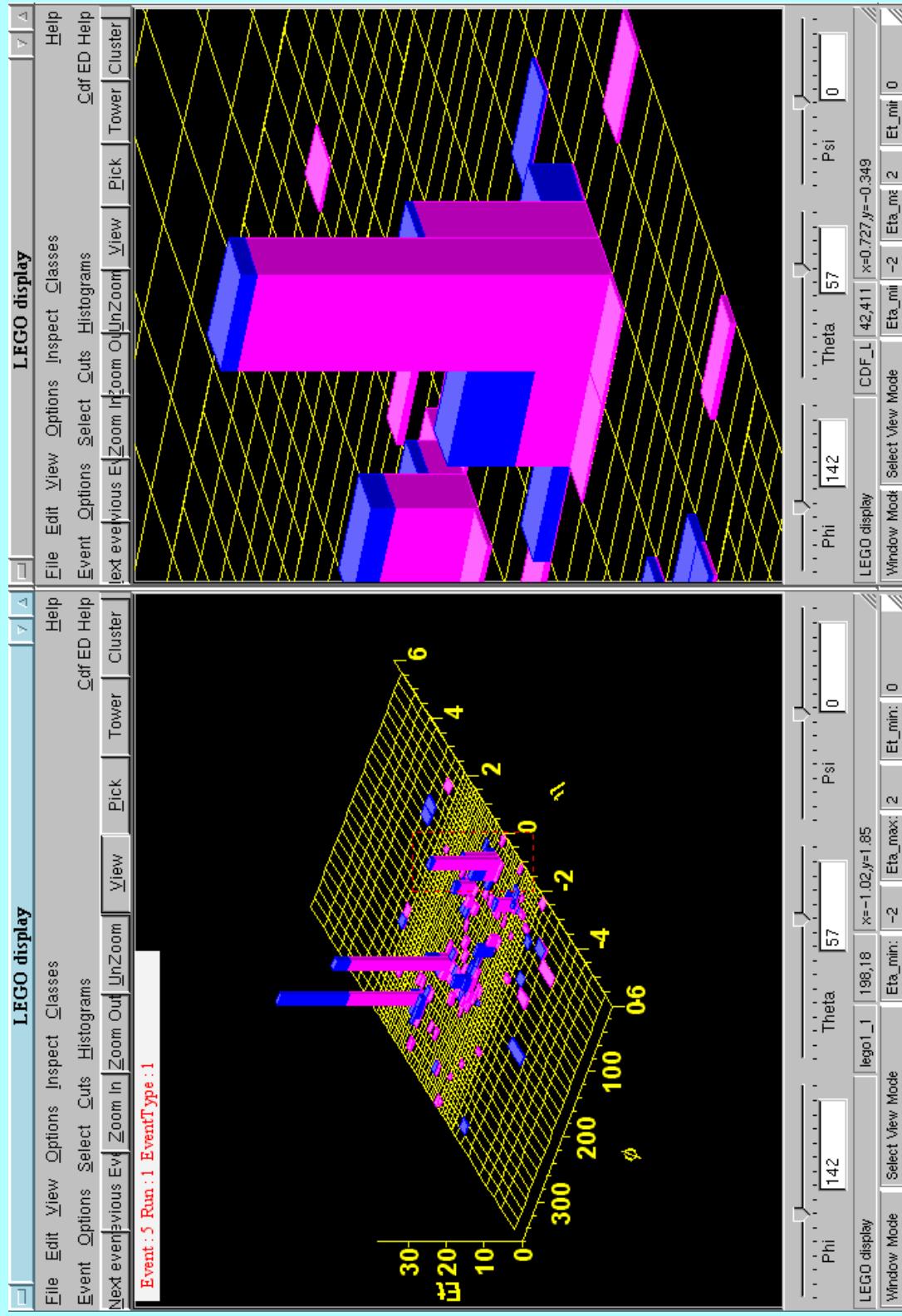
LEGO & COT views





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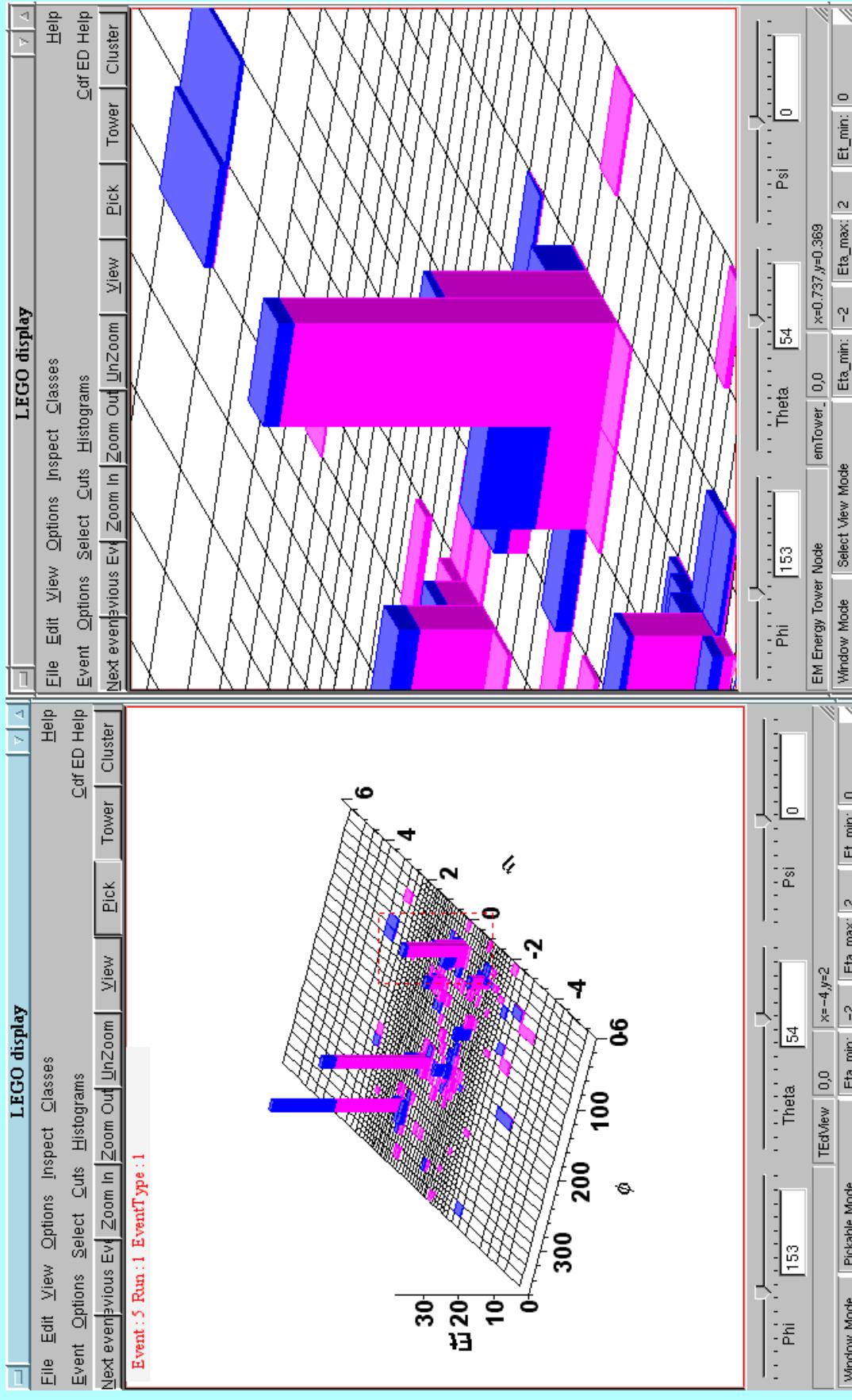
LEGO RubberBand





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LEGO RubberBand



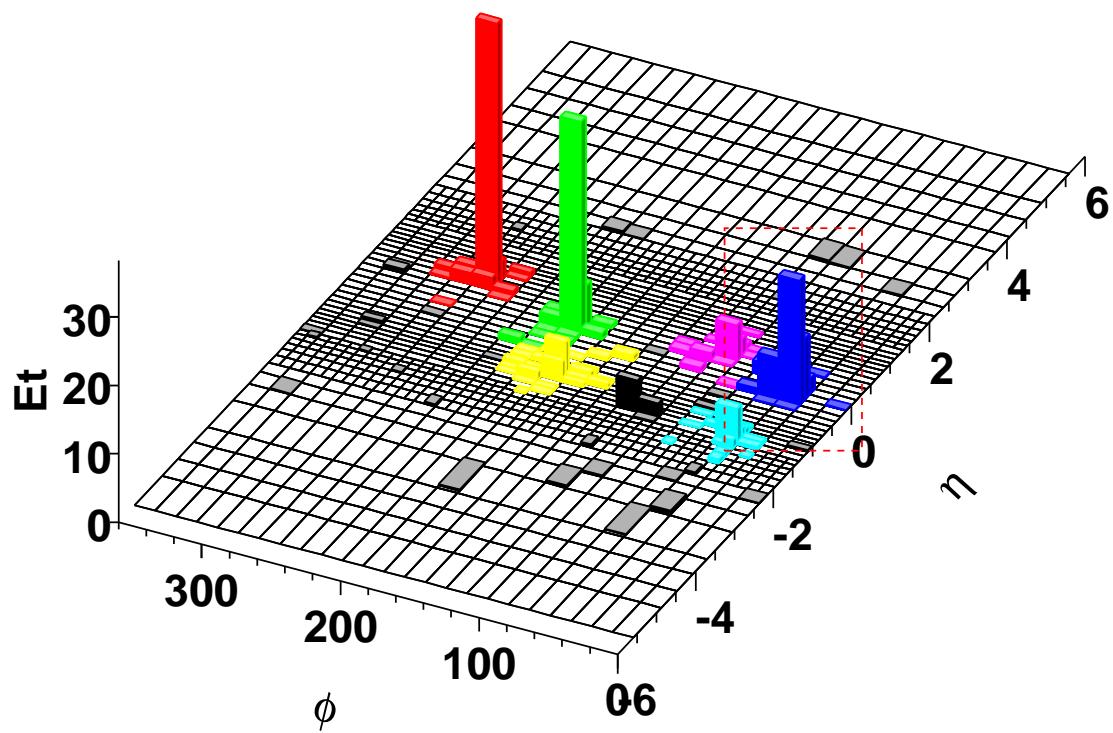
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Jets

Event : 5 Run : 1 EventType : 1

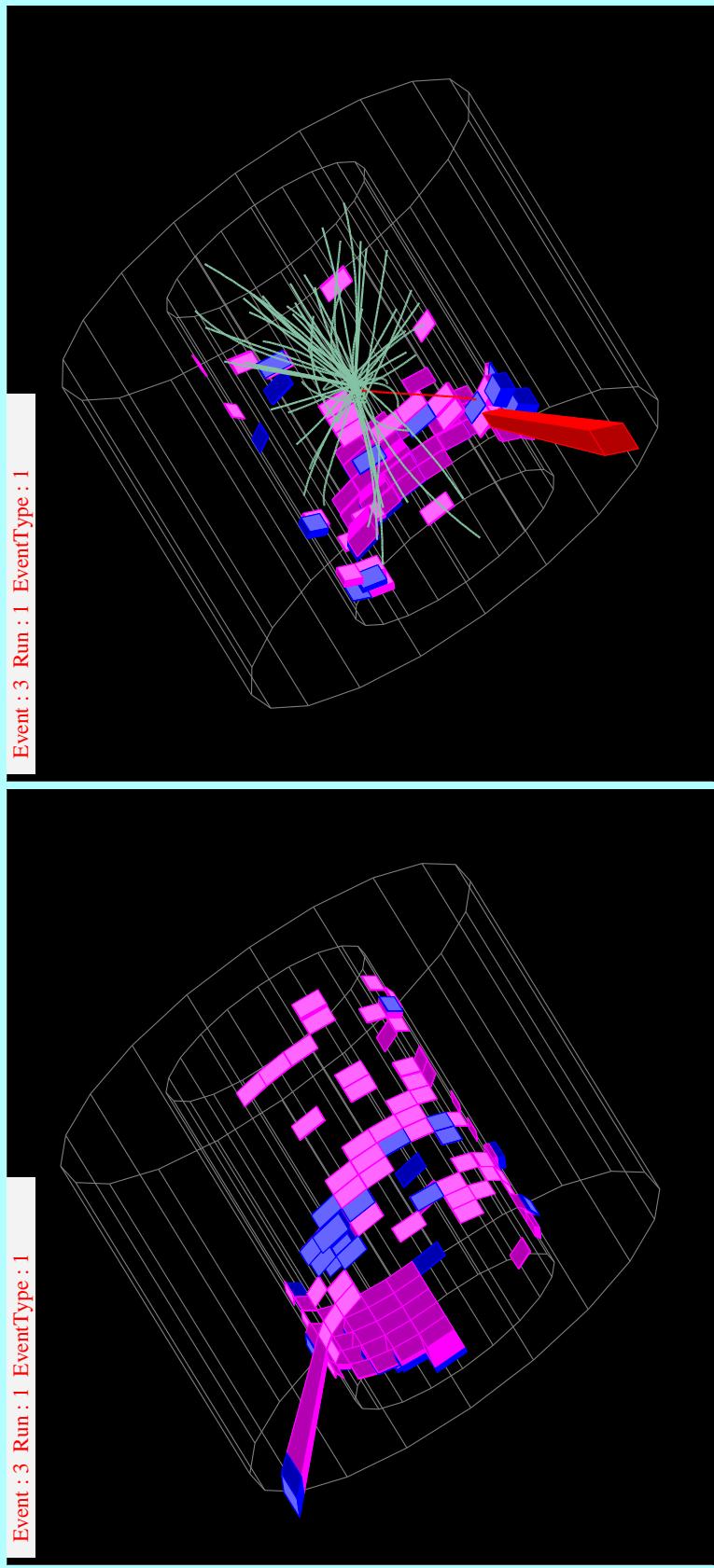


Jets found by **JetClu** module are displayed in different colors.
Towers not assigned to any jet are painted black.



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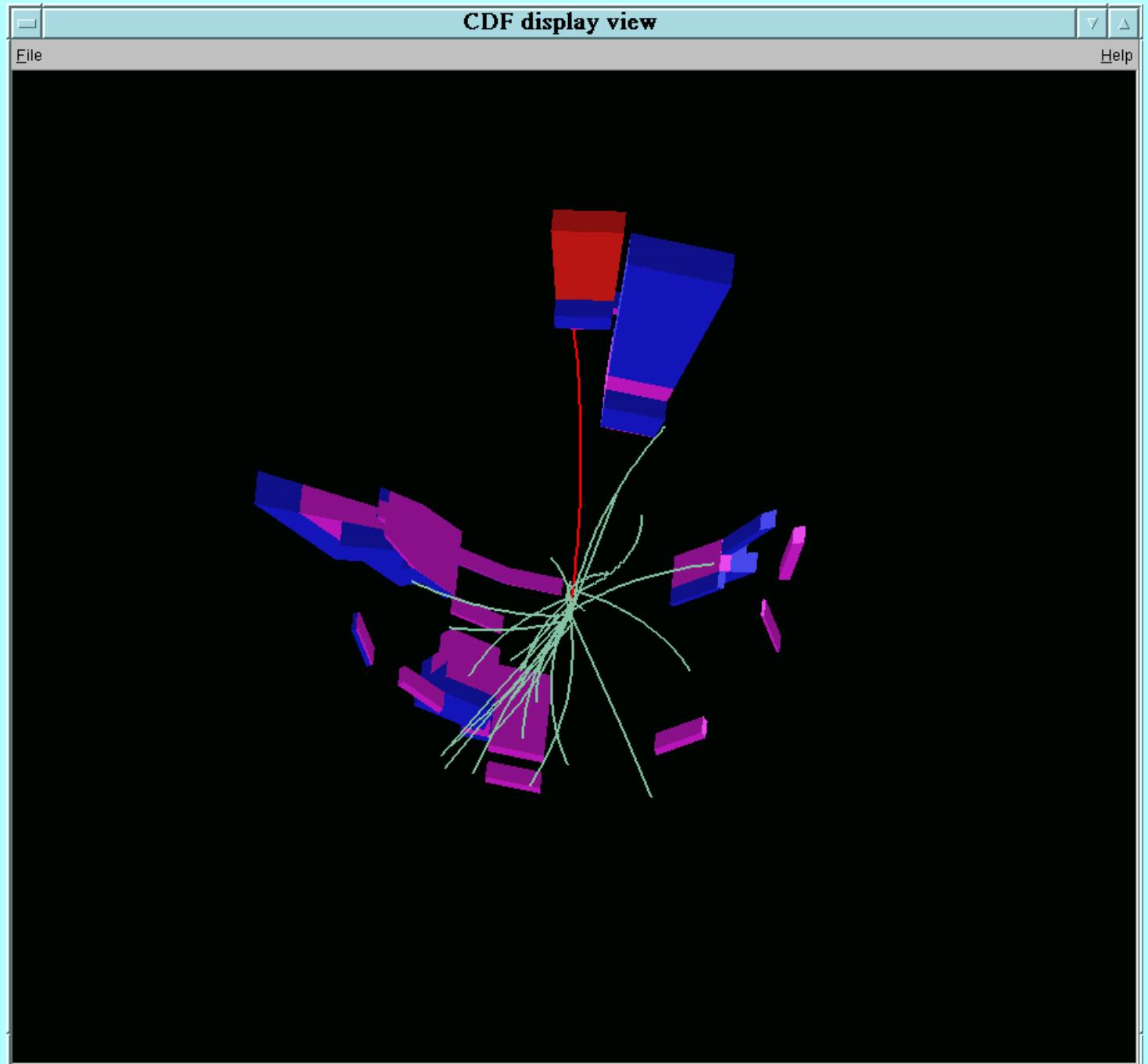
Barrel View





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OpenGL Barrel View

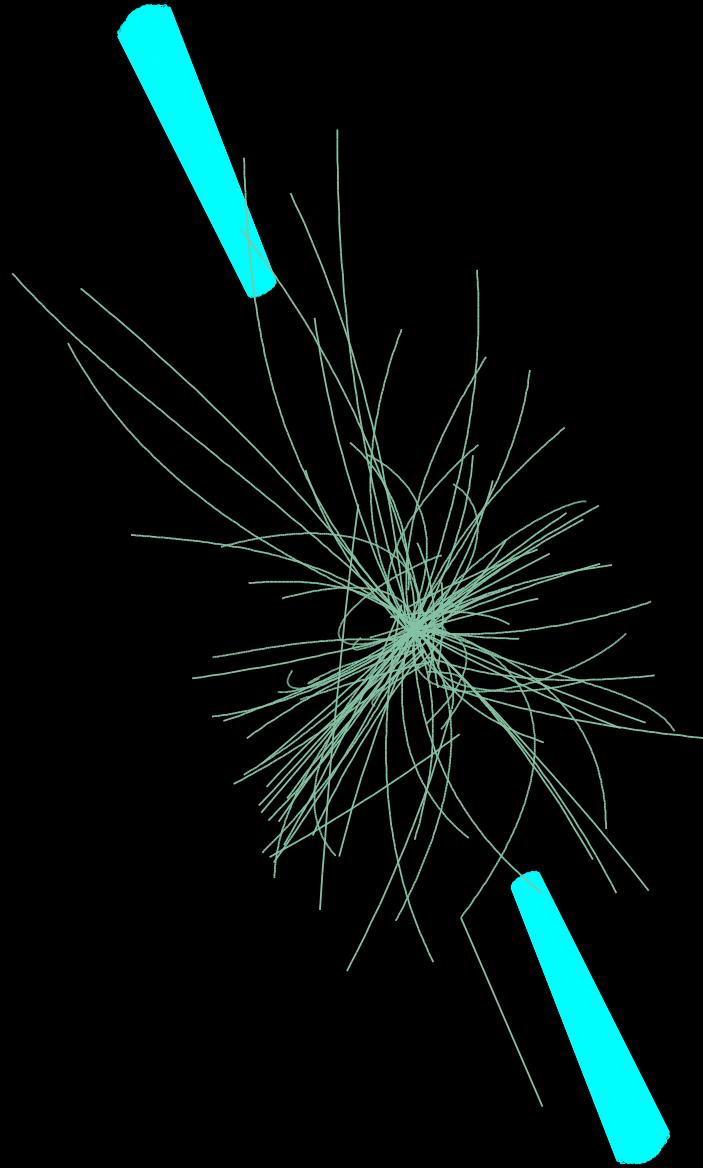




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CLC view

Event : 1 Run : 1 EventType : 1



#:

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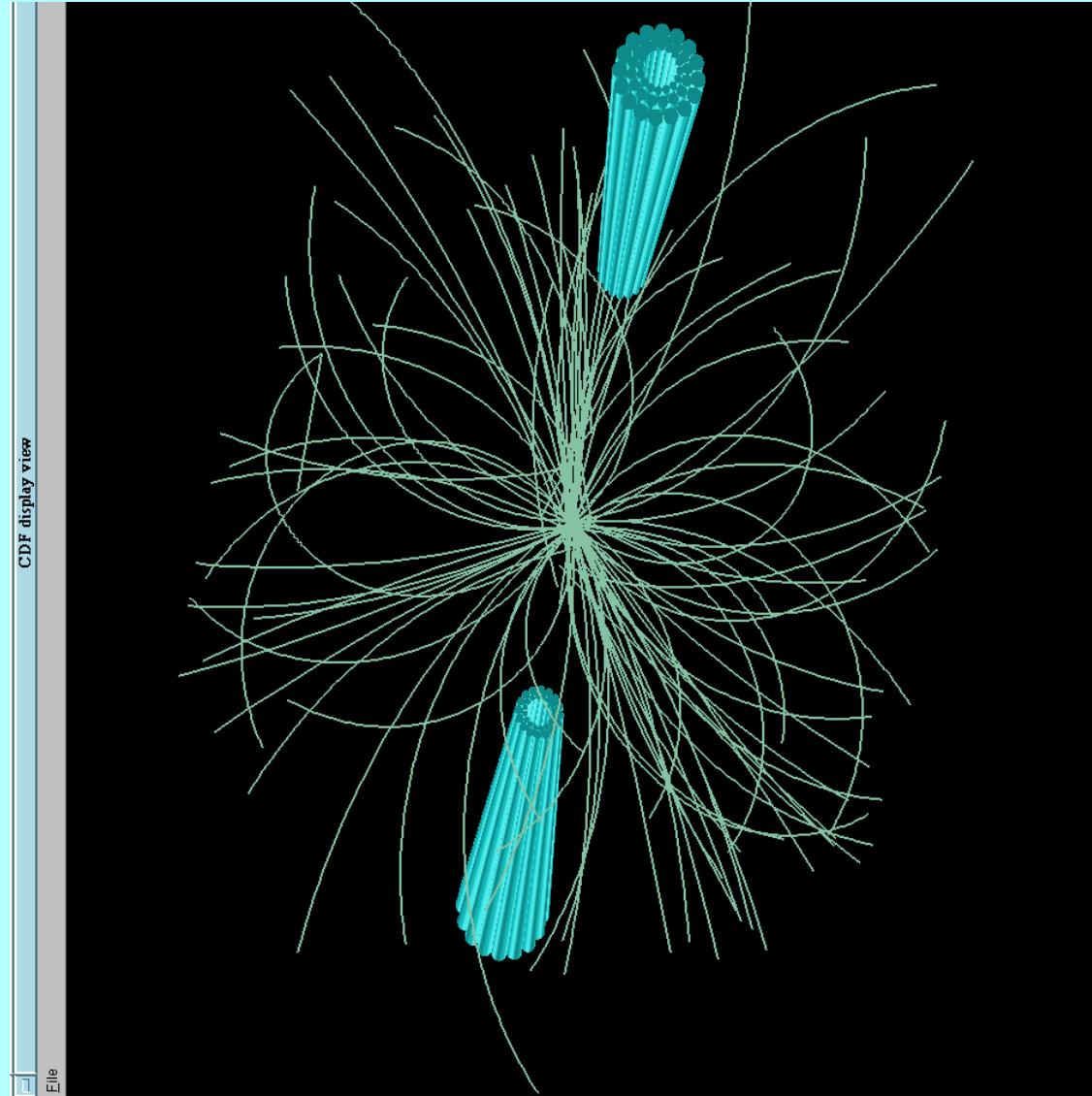
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**OpenGL CLC
view**

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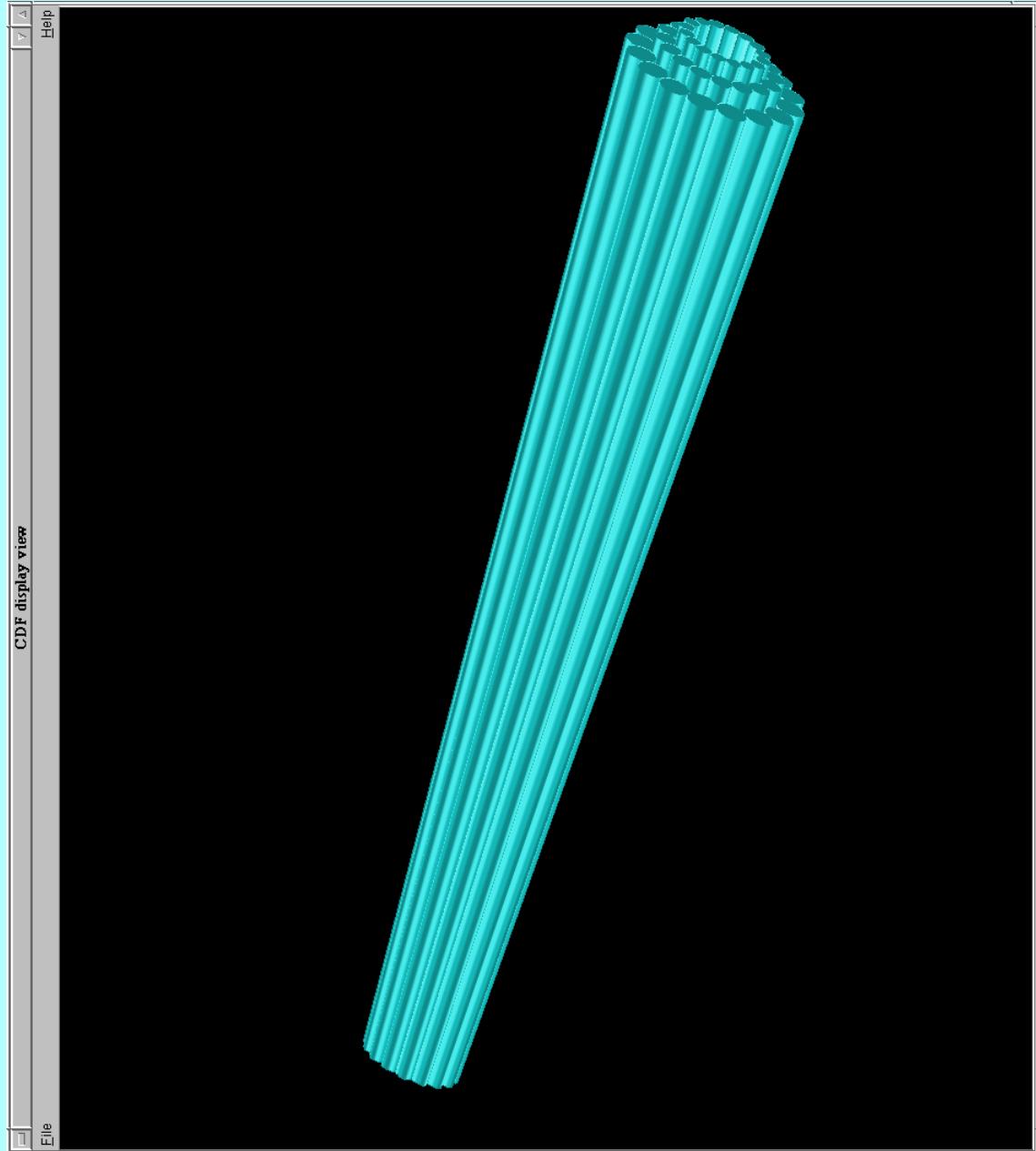


CDF Run II Event Display



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**OpenGL CLC
view**



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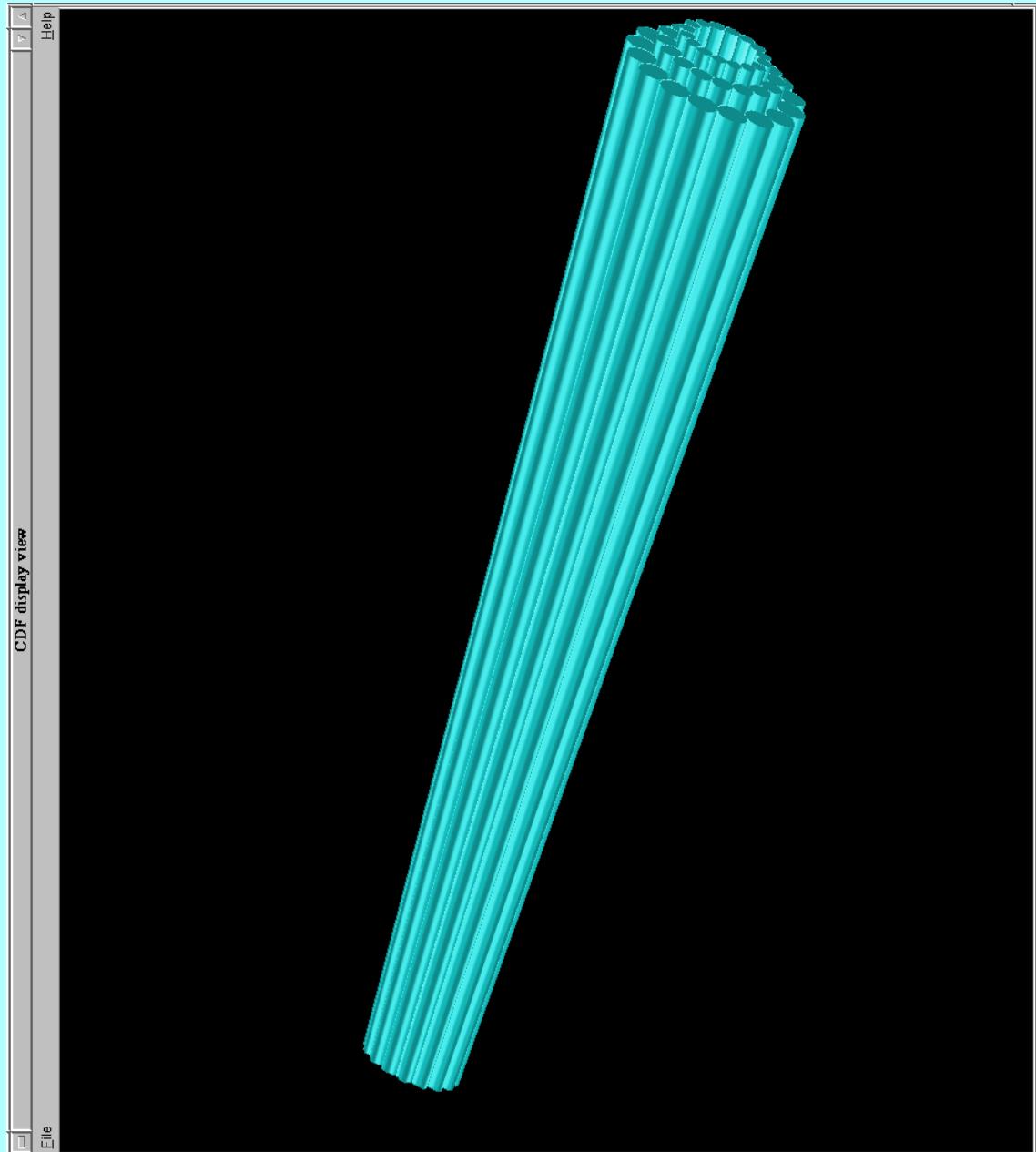
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OpenGL CLC view



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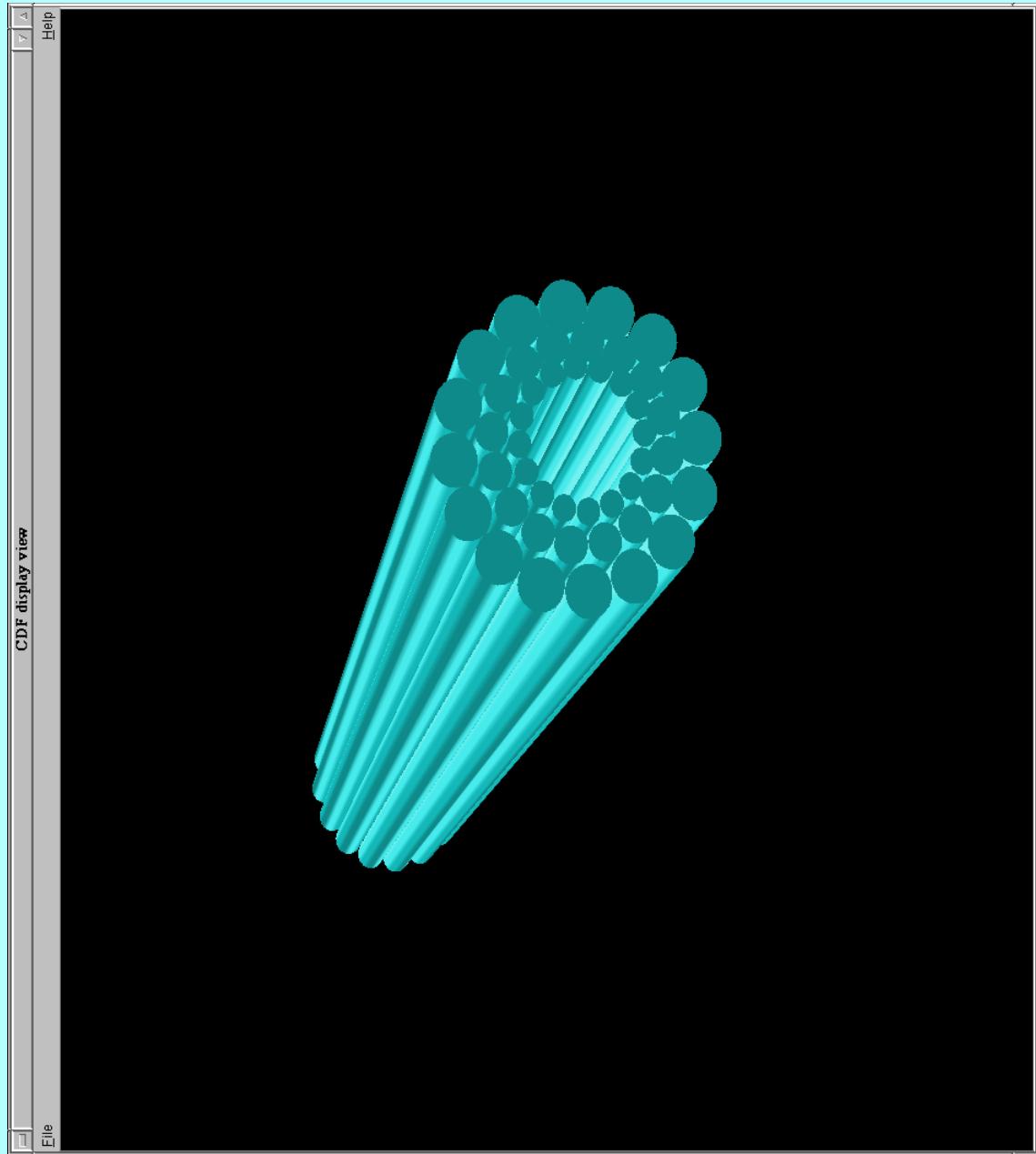
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OpenGL CLC view



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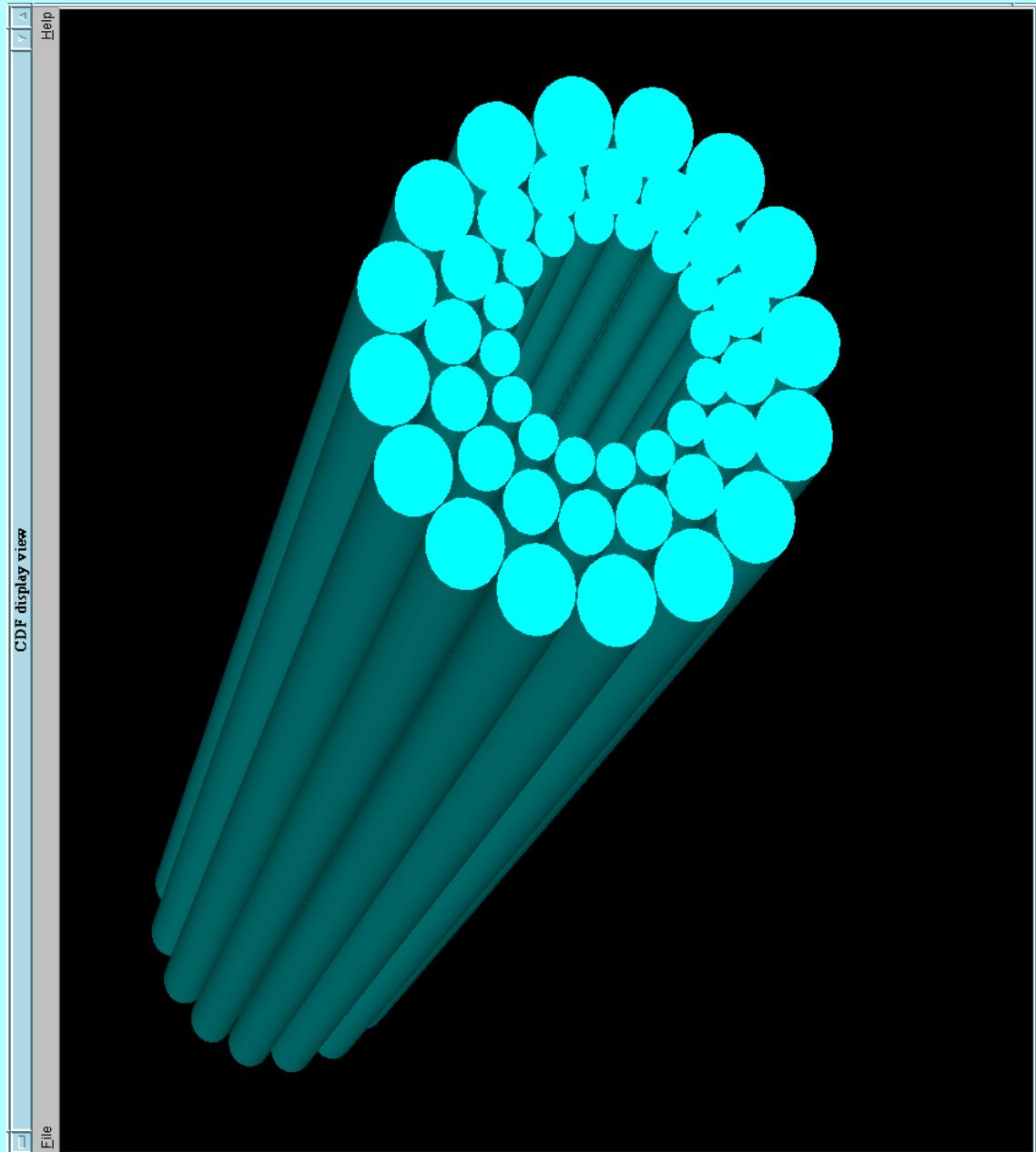
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OpenGL CLC view



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CDF Run II Event Display

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ED Plans

– end of March

- implement drawing of muon stubs

– April

- technical note "CDF RunII ED"
- implementation of the **CLIC** on-line displays
- display of **raw** calorimeter data
- implementation of the **wedge** view (analogous to Run I wedge view)

– May - June

- drawing of trigger towers, and trigger information
- add **track** information to *LEGO* display
- add user interaction like:
refit track
re-cluster jet
- *hidden line removal* for complex shapes like **polygons**, **polycones**, **spheres**
- possibly *segment clipping* algorithm in the Pad
- implement mechanism of convenient setting/saving ED options (using e.g.
`$HOME/.evdrc`)
- implement **displays** on several terminals